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APPENDICES

Appendix A: The Monomeric Sugar Standard Curve of Glucose, Xylose, and Arabinose

The types of monomeric sugar in unknown sample were confirmed by comparing retention time, and the amounts of the monomeric sugar in liquid hydrolysate sample were measured by comparing the peak area with sugar standard used to prepare calibration curve between the peak area and the sugar concentration to obtain the equation used for detecting sugar concentrations. The calibration curve of glucose, xylose, and arabinose are shown below.

Table A1 Peak and retention times of glucose standard

Glucose Concentration (g/l)	Peak Area	Retention Time (min)
1.0	273667	9.151
2.0	556739	9.161
3.0	837347	9.149
4.0	1116667	9.164
5.0	1412402	9.127

Table A2 Peak and retention times of xylose standard

Xylose Concentration (g/l)	Peak Area	Retention Time (min)
1.0	255503	9.756
2.0	528182	9.753
3.0	794934	9.756
4.0	1091071	9.755
5.0	1361445	9.722

Table A3 Peak and retention times of arabinose standard

Arabinose Concentration (g/l)	Peak Area	Retention Time (min)
1.0	256021	10.537
2.0	527612	10.524
3.0	769977	10.527
4.0	1054706	10.518
5.0	1318225	10.488

$y = 4E\text{-}06x + 0.0421$
$R^2 = 0.9999$
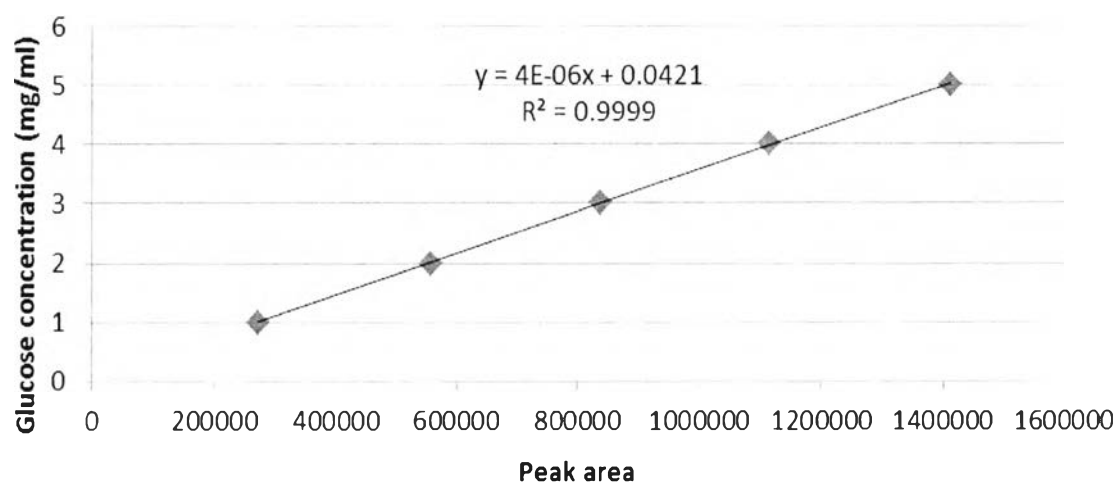
Figure A1 Relationship between peak area and glucose concentration

$y = 4E\text{-}06x + 0.0952$
$R^2 = 0.9997$
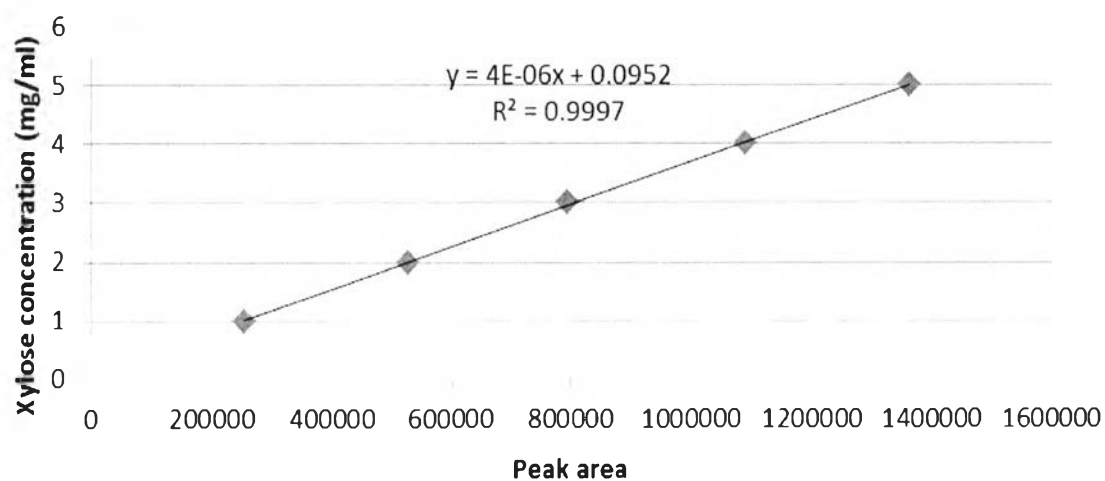
Figure A2 Relationship between peak area and xylose concentration
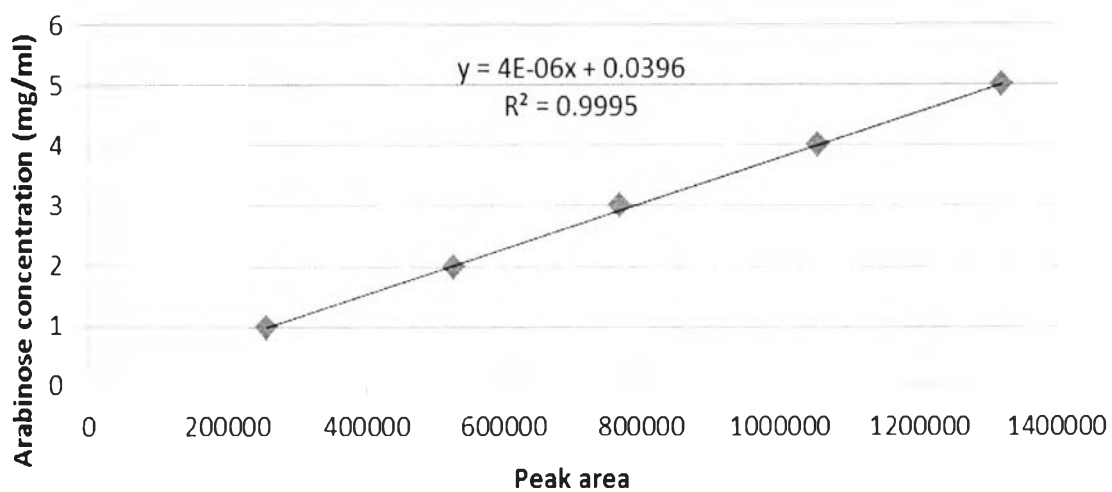
Figure A3 Relationship between peak area and arabinose concentration

Equation of standard glucose: $y = (4 \times 10^{-6})x + 0.0421$

Equation of standard xylose: $y = (4 \times 10^{-6})x + 0.0952$

Equation of standard arabinose: $y = (4 \times 10^{-6})x + 0.0396$

y = sugar concentration (g/l)

x = peak area

Appendix B: The amount of monomeric sugar, pH value, and % solid loss of Mission grass from the two-stage pretreatment process

Table B1 Monomeric sugar yields of Mission grass hydrolysate using 0.5 % (w/v) NaOH and 15:1 LSR at different temperatures for various times.

Pretreatment		Monomeric sugar yields (g/100 g biomass)							
Temperature (°C)	Time (min)	Glucose		Xylose		Arabinose		Total	
		Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
40	5	2.5	0.6	0.5	0.1	0.3	0.0	3.2	0.7
	10	2.9	0.2	0.5	0.1	0.3	0.0	3.7	0.3
	15	2.2	0.3	0.4	0.0	0.3	0.0	2.9	0.3
	30	2.6	0.2	0.6	0.1	0.3	0.0	3.5	0.3
	60	3.4	0.2	0.8	0.1	0.6	0.1	4.8	0.4
60	5	1.7	0.2	0.9	0.1	0.2	0.0	2.8	0.3
	10	3.8	0.2	0.7	0.0	0.5	0.0	5.0	0.2
	15	1.8	0.1	0.9	0.0	0.2	0.0	2.9	0.2
	30	2.0	0.2	0.9	0.1	0.2	0.0	3.1	0.3
	60	2.2	0.2	0.9	0.1	0.2	0.0	3.3	0.3
80	5	2.6	0.1	0.9	0.0	0.2	0.0	3.8	0.2
	10	2.5	0.1	0.9	0.1	0.2	0.0	3.6	0.2
	15	2.5	0.1	0.9	0.0	0.2	0.0	3.6	0.2
	30	2.5	0.1	0.9	0.0	0.4	0.0	3.8	0.2
	60	2.3	0.1	0.8	0.1	0.3	0.1	3.4	0.1
100	5	2.5	0.2	0.8	0.1	0.3	0.1	3.6	0.3
	10	2.6	0.1	0.8	0.0	0.3	0.0	3.6	0.1
	15	2.4	0.3	0.8	0.1	0.3	0.0	3.4	0.4
	30	2.1	0.3	0.8	0.0	0.3	0.0	3.2	0.3
	60	1.8	0.1	0.8	0.0	0.3	0.0	3.0	0.1
120	5	3.7	0.3	1.2	0.1	1.0	0.1	5.9	0.5
	10	3.9	0.2	1.1	0.1	1.0	0.1	6.0	0.3
	15	3.4	0.3	1.0	0.1	0.9	0.1	5.3	0.5
	30	2.9	0.2	0.9	0.1	0.7	0.0	4.4	0.3
	60	3.5	0.3	0.6	0.1	0.8	0.1	5.0	0.4

Data are mean value ± S.D. of three replicates

Table B2 pH, and %solid loss of Mission grass using 0.5 % (w/v) NaOH and 15:1 LSR at different temperatures for various times.

Pretreatment		pH		% Solid loss	
Temperature (°C)	Time (min)	Value	S.D.	Value	S.D.
40	5	10.7	1.3	15.9	1.3
	10	12.6	0.1	15.3	1.3
	15	12.7	0.0	12.4	0.8
	30	12.2	0.1	17.0	1.2
	60	11.8	0.2	19.2	3.9
60	5	12.5	0.0	10.7	2.8
	10	12.1	0.2	17.3	0.5
	15	12.4	0.1	10.8	0.8
	30	12.4	0.1	16.2	0.3
	60	12.1	0.2	18.2	2.6
80	5	12.2	0.1	20.3	1.3
	10	12.1	0.3	18.8	1.1
	15	12.0	0.2	17.7	2.0
	30	11.3	0.2	20.5	2.4
	60	11.5	0.4	24.4	2.6
100	5	11.9	0.2	23.4	1.9
	10	11.2	0.1	24.5	1.3
	15	11.0	0.1	21.6	5.8
	30	10.7	0.1	28.8	2.1
	60	10.6	0.0	35.7	1.1
120	5	10.8	0.1	27.4	4.9
	10	10.7	0.1	30.9	2.8
	15	10.5	0.1	34.0	2.6
	30	10.4	0.1	31.0	4.2
	60	10.4	0.1	37.5	1.3

Data are mean value ± S.D. of three replicates

Table B3 Monomeric sugar yields of Mission grass hydrolysate at 120 °C for 10 min using 15:1 LSR under different NaOH concentrations.

NaOH concentration (% w/v)	Monomeric sugar yields (g/100 g biomass)							
	Glucose		Xylose		Arabinose		Total	
	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
0.1	1.2	0.0	1.0	0.0	0.2	0.0	2.4	0.1
0.25	1.3	0.2	1.0	0.1	0.3	0.0	2.7	0.3
0.5	3.9	0.2	1.1	0.1	1.0	0.1	6.0	0.3
1	3.3	0.3	1.3	0.1	0.6	0.0	5.2	0.5
2	3.2	0.6	1.3	0.1	0.6	0.1	5.1	0.7
3	4.2	0.1	1.5	0.0	0.9	0.0	6.6	0.1
4	3.9	0.2	1.5	0.1	0.9	0.0	6.3	0.3
5	3.7	0.2	1.5	0.0	0.9	0.0	6.1	0.2
6	3.9	0.2	1.6	0.1	0.9	0.0	6.4	0.3
7	3.9	0.2	1.5	0.0	0.9	0.0	6.2	0.2

Data are mean value ± S.D. of three replicates

Table B4 pH and % solid loss of Mission grass hydrolysate at 120 °C for 10 min using 15:1 LSR under different NaOH concentrations.

NaOH concentration (% w/v)	pH		% Solid loss	
	Value	S.D.	Value	S.D.
0.1	7.9	0.1	16.6	1.7
0.25	8.6	0.6	16.4	1.1
0.5	10.7	0.1	30.9	2.8
1	12.4	0.1	38.4	3.8
2	12.7	0.4	38.2	3.5
3	13.3	0.1	41.1	0.7
4	13.2	0.0	41.8	5.7
5	12.9	0.1	31.3	1.5
6	13.3	0.5	32.2	4.0
7	13.0	0.0	34.6	2.8

Data are mean value ± S.D. of three replicates

Table B5 Monomeric sugar yields of microwave/NaOH pretreated Mission grass using 0.5 % (w/v) H_2SO_4 and 15:1 LSR at different temperatures for various times.

| Pretreatment | | Monomeric sugar yields (g/100 g biomass) | | | | | | | |
| Temperature ($^{\circ}$C) | Time (min) | Glucose | | Xylose | | Arabinose | | Total | |
		Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
80	5	0.6	0.1	0.2	0.0	0.1	0.0	0.8	0.1
	10	0.7	0.0	0.2	0.0	0.2	0.0	1.1	0.1
	15	0.7	0.0	0.2	0.0	0.8	0.0	1.7	0.0
	30	0.7	0.0	0.2	0.0	0.9	0.1	1.8	0.1
	60	0.9	0.0	0.3	0.0	1.6	0.1	2.8	0.1
100	5	0.8	0.0	0.3	0.1	1.3	0.0	2.4	0.0
	10	0.8	0.0	0.3	0.0	1.3	0.1	2.3	0.1
	15	0.8	0.1	0.3	0.1	1.4	0.1	2.5	0.2
	30	1.1	0.0	2.3	0.5	1.6	0.1	5.0	0.4
	60	1.3	0.2	3.5	0.7	1.7	0.0	6.6	0.9
140	5	1.0	0.0	2.1	0.7	1.8	0.2	4.9	0.9
	10	1.1	0.0	3.2	0.2	1.9	0.1	6.2	0.2
	15	1.3	0.1	4.5	0.4	1.9	0.2	7.7	0.4
	30	1.8	0.0	5.8	0.1	2.1	0.1	9.7	0.1
	60	2.8	0.4	7.2	0.4	1.5	0.0	11.5	0.8
160	5	3.5	0.6	7.4	0.5	1.4	0.0	12.3	1.1
	10	3.7	0.9	7.7	1.2	1.4	0.1	12.7	2.2
	15	4.1	0.6	7.7	0.7	1.4	0.1	13.2	1.3
	30	5.3	0.7	8.3	0.5	1.3	0.1	14.9	1.3
	60	7.7	0.6	7.5	0.2	1.1	0.0	16.2	0.3
180	5	5.2	0.2	10.8	0.1	1.7	0.0	17.7	0.3
	10	8.0	0.5	11.2	0.7	2.1	0.1	21.3	0.4
	15	10.8	1.8	8.0	2.0	2.0	0.5	21.3	0.3
	30	17.4	1.4	5.4	1.9	1.2	0.1	23.9	0.7
	60	20.0	2.8	3.2	0.1	0.9	0.0	24.1	2.9
200	5	27.2	0.5	4.5	0.3	2.1	0.6	33.7	0.4
	10	24.5	1.4	5.8	1.2	1.4	0.7	31.7	0.9
	15	26.4	2.7	5.0	2.7	1.0	0.4	31.9	0.3
	30	26.5	0.4	2.3	0.0	0.7	0.1	29.6	0.6
	60	22.2	1.7	1.3	0.1	0.5	0.1	24.0	1.9

Data are mean value ± S.D. of three replicates

Table B6 pH and % solid loss of Microwave/NaOH pretreated Mission grass using 0.5 % (w/v) H_2SO_4 and 15:1 LSR at different temperatures for various times.

Pretreatment		pH		% Solid loss	
Temperature (°C)	Time (min)	Value	S.D.	Value	S.D.
80	5	1.7	0.1	7.7	2.0
	10	1.7	0.0	8.4	0.8
	15	1.7	0.0	10.5	0.4
	30	1.6	0.0	8.5	0.6
	60	1.6	0.0	9.2	1.0
100	5	1.8	0.0	11.9	0.9
	10	1.8	0.0	10.9	1.1
	15	1.8	0.0	13.1	0.6
	30	1.7	0.1	13.3	0.8
	60	1.7	0.0	14.6	0.5
140	5	1.7	0.0	22.4	2.2
	10	1.6	0.0	19.8	1.0
	15	1.6	0.0	19.3	0.4
	30	1.6	0.0	20.3	0.2
	60	1.8	0.0	23.5	0.1
160	5	1.7	0.0	19.3	0.7
	10	1.7	0.0	22.0	2.4
	15	1.7	0.0	19.1	0.0
	30	1.7	0.0	23.2	2.5
	60	1.7	0.0	27.6	2.2
180	5	1.9	0.0	29.2	0.5
	10	1.6	0.0	33.9	0.3
	15	1.7	0.0	32.6	2.3
	30	1.6	0.0	41.5	4.2
	60	1.6	0.0	48.9	2.5
200	5	1.5	0.0	64.1	3.1
	10	1.6	0.1	49.7	3.5

	15	1.8	0.0	65.8	18.6
	30	1.8	0.0	70.0	1.6
	60	1.8	0.0	76.0	0.0

Data are mean value ± S.D. of three replicates

Table B7 Monomeric sugar yields of microwave/NaOH pretreated Mission grass at 200 °C for 5 min using 15:1 LSR under different H_2SO_4 concentrations.

H_2SO_4 concentration (% w/v)	Monomeric sugar yields (g/100 g biomass)							
	Glucose		Xylose		Arabinose		Total	
	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
0.5	27.2	0.5	4.5	0.3	2.1	0.6	33.7	0.4
1	31.1	0.8	2.2	0.4	1.0	0.2	34.3	1.3
2	22.1	3.3	2.7	1.4	0.7	0.2	25.5	4.9
3	4.1	0.4	1.3	0.1	0.6	0.0	6.0	0.5

Data are mean value ± S.D. of three replicates

Table B8 pH and % solid loss of microwave/NaOH pretreated Mission grass at 200 °C for 5 min using 15:1 LSR under different H_2SO_4 concentrations.

H_2SO_4 concentration (% w/v)	pH		% Solid loss	
	Value	S.D.	Value	S.D.
0.5	1.5	0.0	64.1	3.1
1	1.3	0.2	72.0	0.5
2	1.1	0.0	66.8	8.6
3	1.0	0.0	86.8	0.7

Data are mean value ± S.D. of three replicates

Appendix C The amount of monomeric sugar, pH value, and % solid loss of Kans grass from two stage pretreatment process

Table C1 Monomeric sugar yields of Kans grass hydrolysate using 0.5 % (w/v) NaOH and 15:1 LSR at different temperatures for various times

Pretreatment		Monomeric sugar yields (g/100 g biomass)							
Temperature	Time	Glucose		Xylose		Arabinose		Total	
(°C)	(min)	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
40	5	0.4	0.1	1.0	0.1	0.5	0.1	1.9	0.2
	10	0.8	0.0	1.0	0.0	0.6	0.0	2.4	0.0
	15	0.5	0.1	0.9	0.1	0.5	0.0	1.9	0.2
	30	0.7	0.0	0.9	0.1	0.5	0.1	2.1	0.2
	60	1.1	0.0	0.9	0.1	0.5	0.0	2.5	0.1
60	5	1.6	0.1	1.7	0.0	0.3	0.0	3.6	0.1
	10	1.4	0.1	1.0	0.0	0.7	0.0	3.0	0.2
	15	1.6	0.0	1.6	0.0	0.2	0.0	3.4	0.0
	30	1.8	0.1	1.6	0.0	0.2	0.0	3.6	0.0
	60	1.9	0.1	1.6	0.0	0.2	0.0	3.7	0.0
80	5	2.4	0.1	1.9	0.1	0.5	0.0	4.8	0.2
	10	2.2	0.0	1.7	0.0	0.5	0.0	4.4	0.1
	15	2.1	0.1	1.5	0.0	0.3	0.0	4.0	0.2
	30	2.4	0.1	1.6	0.1	0.5	0.1	4.5	0.3
	60	2.4	0.0	1.6	0.0	0.6	0.0	4.6	0.1
100	5	2.3	0.1	1.6	0.0	0.5	0.0	4.4	0.1
	10	2.4	0.1	1.6	0.0	0.6	0.0	4.6	0.2
	15	2.3	0.1	1.6	0.1	0.6	0.0	4.5	0.2
	30	1.6	0.1	1.6	0.1	0.6	0.0	3.9	0.2
	60	1.3	0.1	1.4	0.0	0.4	0.1	3.1	0.1
120	5	1.9	0.1	1.4	0.0	0.5	0.1	3.8	0.0
	10	1.7	0.2	1.5	0.0	0.3	0.2	3.5	0.2
	15	1.3	0.3	1.4	0.0	0.5	0.1	3.2	0.2
	30	1.0	0.1	1.2	0.1	0.5	0.0	2.7	0.2
	60	0.5	0.1	0.9	0.0	0.8	0.0	2.2	0.1

Data are mean value ± S.D. of three replicates

Table C2 pH, and %solid loss of Kans grass using 0.5 % (w/v) NaOH and 15:1 LSR at different temperatures for various times.

Pretreatment		pH		% Solid loss	
Temperature (°C)	Time (min)	Value	S.D.	Value	S.D.
40	5	12.6	0.0	15.5	0.2
	10	12.6	0.0	18.6	0.4
	15	12.6	0.1	15.9	0.7
	30	11.7	1.4	18.7	1.5
	60	12.2	0.1	23.8	0.5
60	5	12.5	0.1	13.3	0.5
	10	12.0	0.3	21.1	0.5
	15	12.4	0.1	15.8	0.2
	30	12.2	0.3	18.0	3.2
	60	12.1	0.1	23.0	0.9
80	5	11.8	0.3	23.3	1.5
	10	12.0	0.6	22.8	0.8
	15	11.8	0.1	23.2	1.7
	30	11.1	0.1	26.0	0.3
	60	11.1	0.1	28.6	2.1
100	5	11.6	0.3	26.0	0.5
	10	11.1	0.1	29.3	2.8
	15	10.9	0.1	28.7	0.8
	30	10.5	0.1	31.5	1.9
	60	10.4	0.1	34.8	0.7
120	5	10.8	0.1	28.4	1.2
	10	10.5	0.1	32.9	1.0
	15	10.4	0.1	34.5	0.6
	30	10.2	0.1	34.8	2.6
	60	9.9	0.1	40.5	0.9

Data are mean value ± S.D. of three replicates

Table C3 Monomeric sugar yields of Kans grass hydrolysate at 80 °C for 5 min using 15:1 LSR under different NaOH concentrations.

NaOH concentration (% w/v)	Monomeric sugar yields (g/100 g biomass)							
	Glucose		Xylose		Arabinose		Total	
	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
0.1	1.2	0.1	1.8	0.2	0.4	0.0	3.5	0.2
0.25	1.4	0.0	1.7	0.1	0.3	0.0	3.5	0.1
0.5	2.4	0.1	1.9	0.1	0.5	0.0	4.8	0.2
1	2.7	0.1	2.1	0.1	0.6	0.0	5.4	0.2
2	2.7	0.1	2.1	0.1	0.6	0.0	5.4	0.2
3	3.5	0.5	2.2	0.2	0.7	0.1	6.4	0.8
4	3.6	0.2	2.2	0.0	0.7	0.0	6.5	0.2
5	3.6	0.2	2.5	0.1	0.7	0.0	6.8	0.3
6	3.5	0.1	2.4	0.1	0.7	0.0	6.6	0.3
7	3.5	0.3	2.4	0.2	0.7	0.0	6.6	0.5

Data are mean value ± S.D. of three replicates

Table C4 pH and % solid loss of Kans grass hydrolysate at 80 °C for 5 min using 15:1 LSR under different NaOH concentrations.

NaOH concentration (% w/v)	pH		% Solid loss	
	Value	S.D.	Value	S.D.
0.1	8.0	0.2	17.9	0.8
0.25	9.2	0.7	18.5	1.0
0.5	11.8	0.6	23.3	1.5
1	12.5	0.2	26.6	3.4
2	13.1	0.0	32.4	3.4
3	13.2	0.0	26.5	4.2
4	13.1	0.2	28.0	3.9
5	13.1	0.0	34.5	3.1
6	13.1	0.0	25.9	7.5
7	13.1	0.0	25.8	12.1

Data are mean value ± S.D. of three replicates

Table C5 Monomeric sugar yields of microwave/NaOH pretreated Kans grass using 0.5 % (w/v) H_2SO_4 and 15:1 LSR at different temperatures for various times.

Pretreatment		Monomeric sugar yields (g/100 g biomass)							
Temperature ($^\circ$C)	Time (min)	Glucose		Xylose		Arabinose		Total	
		Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
80	5	0.5	0.0	0.2	0.0	0.2	0.0	0.8	0.0
	10	0.5	0.0	0.2	0.0	0.3	0.0	0.9	0.0
	15	0.5	0.0	0.2	0.0	1.0	0.1	1.7	0.1
	30	0.6	0.0	0.2	0.0	0.9	0.2	1.6	0.2
	60	0.7	0.0	0.3	0.0	1.6	0.1	2.5	0.1
100	5	0.5	0.0	0.4	0.1	1.5	0.0	2.4	0.1
	10	0.5	0.0	0.4	0.1	1.2	0.3	2.1	0.3
	15	0.6	0.0	0.5	0.0	1.5	0.1	2.5	0.1
	30	1.7	0.0	5.2	0.1	1.7	0.1	8.6	0.1
	60	1.1	0.3	3.9	0.9	1.6	0.0	6.6	1.0
140	5	0.7	0.1	2.7	0.8	2.0	0.1	5.4	1.0
	10	0.5	0.0	3.3	0.5	1.8	0.0	5.6	0.5
	15	0.6	0.2	3.3	1.2	1.9	0.2	5.9	1.4
	30	2.1	0.4	6.7	0.8	2.3	0.1	11.1	1.3
	60	2.4	0.5	6.2	0.8	1.7	0.1	10.3	1.3
160	5	1.3	0.3	5.6	0.9	2.0	0.2	8.9	1.4
	10	2.7	0.4	6.9	0.2	1.8	0.1	11.4	0.5
	15	2.7	0.6	7.6	1.2	1.9	0.1	12.2	1.9
	30	5.7	0.5	8.7	0.1	1.7	0.1	16.0	0.6
	60	7.2	1.6	7.8	0.6	1.5	0.1	16.5	0.9
180	5	5.2	0.9	10.4	0.4	2.3	0.0	17.8	1.3
	10	12.8	1.4	8.6	0.3	1.9	0.1	23.3	1.5
	15	12.0	2.6	8.9	1.0	1.9	0.1	22.8	1.9
	30	14.5	2.3	6.9	1.2	2.5	0.0	23.9	1.1
	60	9.8	1.6	10.1	1.0	2.2	0.1	22.1	2.7
200	5	12.9	3.9	8.8	1.4	2.2	0.2	23.9	2.3
	10	26.3	2.9	6.7	0.9	0.8	0.0	33.8	3.9
	15	22.5	0.9	4.8	2.3	1.3	0.6	28.5	0.9
	30	22.3	2.1	3.5	0.7	0.9	0.2	26.7	1.3
	60	1.4	0.5	0.6	0.3	0.3	0.0	2.4	0.8

Data are mean value ± S.D. of three replicates

Table C6 pH and % solid loss of microwave/NaOH pretreated Kans grass using 0.5 % (w/v) H_2SO_4 and 15:1 LSR at different temperatures for various times.

Pretreatment		pH		% Solid loss	
Temperature (^{o}C)	Time (min)	Value	S.D.	Value	S.D.
80	5	1.6	0.0	10.4	1.7
	10	1.6	0.0	10.3	1.1
	15	1.6	0.0	10.9	0.7
	30	1.6	0.0	9.7	1.3
	60	1.6	0.0	9.9	0.5
100	5	1.8	0.0	11.9	0.2
	10	1.8	0.0	11.3	1.0
	15	1.7	0.0	11.6	0.9
	30	1.7	0.0	17.4	1.0
	60	1.6	0.0	14.5	0.9
140	5	1.7	0.0	9.9	2.8
	10	1.5	0.0	18.7	0.5
	15	1.6	0.0	15.3	1.2
	30	1.6	0.0	25.4	1.3
	60	1.7	0.0	22.3	0.6
160	5	1.6	0.0	21.7	1.5
	10	1.7	0.0	20.0	2.0
	15	1.6	0.0	19.7	0.7
	30	1.7	0.0	25.5	0.2
	60	1.7	0.0	27.0	2.2
180	5	1.8	0.0	21.6	1.7
	10	1.7	0.1	32.3	1.8
	15	1.7	0.1	30.1	2.8
	30	1.7	0.0	36.2	5.1
	60	1.8	0.0	29.6	5.0
200	5	1.7	0.0	35.8	3.0

	10	1.8	0.0	77.7	3.8
	15	1.8	0.0	60.4	3.1
	30	1.5	0.0	62.9	13.7
	60	1.7	0.0	71.3	1.4

Data are mean value ± S.D. of three replicates

Table C7 Monomeric sugar yields of microwave/NaOH pretreated Kans grass at 200 °C for 10 min using 15:1 LSR under different H_2SO_4 concentrations.

H_2SO_4 concentration (% w/v)	Monomeric sugar yields (g/100 g biomass)							
	Glucose		Xylose		Arabinose		Total	
	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
0.5	26.3	2.9	6.7	0.9	0.8	0.0	33.8	3.9
1	21.1	4.0	1.6	0.1	0.7	0.0	23.4	4.1
2	20.6	1.9	2.8	1.9	1.0	0.6	24.4	3.2
3	4.8	3.9	1.0	0.1	0.7	0.0	6.5	3.9

Data are mean value ± S.D. of three replicates

Table C8 pH and % solid loss of microwave/NaOH pretreated Kans grass at 200 °C for 10 min using 15:1 LSR under different H_2SO_4 concentrations.

H_2SO_4 concentration (% w/v)	pH		% Solid loss	
	Value	S.D.	Value	S.D.
0.5	1.8	0.0	77.7	3.8
1	1.1	0.1	83.9	0.7
2	1.1	0.1	82.6	0.7
3	1.0	0.0	80.2	0.1

Data are mean value ± S.D. of three replicates

Appendix D The amount of monomeric sugar, pH value, and % solid loss of Giant reed from two stage pretreatment process

Table D1 Monomeric sugar yields of Giant reed hydrolysate using 0.5 % (w/v) NaOH and 15:1 LSR at different temperatures for various times.

Pretreatment		Monomeric sugar yields (g/100 g biomass)							
Temperature	Time	Glucose		Xylose		Arabinose		Total	
(°C)	(min)	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
40	5	0.5	0.1	0.5	0.0	0.3	0.0	1.3	0.2
	10	0.9	0.1	0.6	0.0	0.3	0.0	1.8	0.1
	15	0.6	0.0	0.5	0.0	0.3	0.0	1.4	0.0
	30	0.6	0.0	0.5	0.0	0.3	0.0	1.3	0.0
	60	1.0	0.0	0.6	0.0	0.3	0.0	1.9	0.0
60	5	1.1	0.1	0.9	0.0	0.2	0.0	2.3	0.1
	10	1.5	0.1	0.8	0.0	0.5	0.0	2.8	0.2
	15	1.2	0.1	0.9	0.0	0.2	0.0	2.4	0.1
	30	1.5	0.1	0.9	0.0	0.3	0.0	2.6	0.1
	60	1.5	0.2	0.9	0.1	0.4	0.0	2.8	0.3
80	5	1.9	0.0	0.9	0.1	0.3	0.0	3.1	0.0
	10	1.8	0.1	0.8	0.0	0.3	0.0	2.9	0.2
	15	1.9	0.0	0.8	0.1	0.3	0.0	3.0	0.1
	30	1.9	0.5	0.6	0.0	0.3	0.0	2.9	0.5
	60	1.8	0.0	0.7	0.0	0.3	0.0	2.8	0.0
100	5	2.1	0.2	0.6	0.0	0.3	0.2	3.1	0.2
	10	2.3	0.1	0.6	0.0	0.3	0.1	3.3	0.1
	15	2.3	0.1	0.7	0.0	0.3	0.1	3.3	0.1
	30	1.6	0.4	0.7	0.0	0.3	0.0	2.6	0.4
	60	1.3	0.1	0.7	0.1	0.4	0.1	2.4	0.1
120	5	2.1	0.1	1.5	0.0	1.0	0.0	4.5	0.1
	10	2.0	0.0	1.4	0.0	0.9	0.0	4.4	0.1
	15	1.8	0.2	1.3	0.1	0.9	0.1	4.0	0.4
	30	1.1	0.3	0.9	0.2	0.7	0.1	2.7	0.7
	60	0.7	0.4	0.5	0.1	0.7	0.1	1.9	0.6

Data are mean value ± S.D. of three replicates

Table D2 pH, and %solid loss of Giant reed using 0.5 % (w/v) NaOH and 15:1 LSR at different temperatures for various times.

Pretreatment		pH		% Solid loss	
Temperature (°C)	Time (min)	Value	S.D.	Value	S.D.
40	5	12.7	0.1	13.5	1.3
	10	12.7	0.1	13.7	1.1
	15	12.8	0.0	11.0	0.3
	30	12.7	0.1	14.0	1.4
	60	12.4	0.0	18.3	0.5
60	5	12.7	0.1	10.2	4.9
	10	12.6	0.0	15.8	1.3
	15	12.6	0.0	12.1	1.3
	30	12.5	0.1	15.4	0.1
	60	12.3	0.1	16.1	1.3
80	5	12.6	0.1	18.3	0.9
	10	12.6	0.2	16.8	0.8
	15	12.5	0.5	18.4	2.1
	30	12.1	0.7	21.3	1.6
	60	12.3	0.1	20.0	1.1
100	5	11.9	0.4	20.7	2.3
	10	11.3	0.3	24.0	0.3
	15	11.0	0.2	23.5	1.0
	30	10.6	0.3	27.1	1.1
	60	10.5	0.1	30.7	1.7
120	5	10.9	0.2	25.4	0.9
	10	10.8	0.0	27.6	1.8
	15	10.6	0.1	27.2	1.7
	30	10.3	0.2	28.6	1.4
	60	9.9	0.6	32.5	2.2

Data are mean value ± S.D. of three replicates

Table D3 Monomeric sugar yields of Giant reed hydrolysate at 120 °C for 5 min using 15:1 LSR under different NaOH concentrations.

NaOH concentration (% w/v)	Monomeric sugar yields (g/100 g biomass)							
	Glucose		Xylose		Arabinose		Total	
	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
0.1	1.0	0.0	1.1	0.0	0.2	0.0	2.3	0.0
0.25	0.8	0.1	0.9	0.1	0.4	0.0	2.0	0.2
0.5	2.1	0.1	1.5	0.0	1.0	0.0	4.5	0.1
1	3.4	0.6	1.2	0.2	0.5	0.1	5.1	0.9
2	4.0	0.2	1.1	0.1	0.6	0.0	5.8	0.3
3	4.5	0.1	1.4	0.0	0.8	0.0	6.7	0.2
4	4.4	0.3	1.4	0.0	0.8	0.0	6.6	0.3
5	4.5	0.1	1.5	0.0	0.9	0.0	6.8	0.2
6	4.4	0.2	1.4	0.1	0.8	0.0	6.6	0.2
7	4.2	0.2	1.4	0.0	0.8	0.0	6.4	0.2

Data are mean value ± S.D. of three replicates

Table D4 pH and % solid loss of Giant reed hydrolysate at 120 °C for 5 min using 15:1 LSR under different NaOH concentrations.

NaOH concentration (% w/v)	pH		% Solid loss	
	Value	S.D.	Value	S.D.
0.1	7.7	0.0	15.3	0.4
0.25	8.5	0.1	17.3	1.2
0.5	10.9	0.2	25.4	0.9
1	11.3	1.3	28.6	3.3
2	13.0	0.1	30.2	2.0
3	13.1	0.1	34.1	2.5
4	13.2	0.0	32.9	3.1
5	13.2	0.0	28.4	6.7
6	13.1	0.0	20.4	12.5
7	13.1	0.0	31.3	0.0

Data are mean value ± S.D. of three replicates

Table D5 Monomeric sugar yields of microwave/NaOH pretreated Giant reed using 0.5 % (w/v) H_2SO_4 and 15:1 LSR at different temperatures for various times.

Pretreatment		Monomeric sugar yields (g/100 g biomass)							
Temperature	Time	Glucose		Xylose		Arabinose		Total	
(°C)	(min)	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
80	5	0.1	0.0	0.2	0.0	0.2	0.0	0.5	0.0
	10	0.2	0.0	0.2	0.0	0.2	0.0	0.6	0.0
	15	0.2	0.0	0.2	0.0	1.0	0.1	1.4	0.1
	30	0.2	0.0	0.2	0.0	1.0	0.2	1.3	0.3
	60	0.3	0.0	0.2	0.0	1.3	0.1	1.8	0.1
100	5	0.2	0.0	0.3	0.1	1.1	0.0	1.6	0.1
	10	0.2	0.0	0.4	0.1	1.1	0.0	1.8	0.2
	15	0.3	0.0	0.5	0.2	1.2	0.1	1.9	0.3
	30	0.8	0.1	3.4	0.3	1.3	0.0	5.5	0.4
	60	1.1	0.2	3.9	0.7	1.3	0.0	6.3	1.0
140	5	0.4	0.1	2.1	0.3	1.5	0.0	4.0	0.3
	10	0.5	0.2	2.3	1.7	1.5	0.1	4.3	2.0
	15	1.2	0.4	4.8	1.1	1.4	0.1	7.4	1.6
	30	3.5	0.7	7.8	0.5	1.4	0.1	12.7	1.2
	60	2.8	1.2	7.2	0.8	1.4	0.0	11.5	1.9
160	5	3.2	1.2	7.8	0.9	1.5	0.0	12.4	2.1
	10	2.4	0.4	7.3	0.3	1.5	0.1	11.2	0.6
	15	3.0	0.5	6.8	0.4	1.3	0.0	11.1	0.9
	30	5.0	1.2	7.6	0.1	1.4	0.0	13.9	1.3
	60	6.0	0.3	7.4	0.1	1.3	0.0	14.7	0.2
180	5	6.6	0.0	8.8	0.4	1.5	0.1	16.9	0.4
	10	7.0	0.7	7.6	0.3	1.2	0.1	15.7	0.8
	15	14.7	0.5	6.7	0.0	1.4	0.0	22.7	0.5
	30	26.4	2.5	4.3	0.7	1.2	0.1	31.9	1.7
	60	20.9	0.1	4.6	1.3	1.0	0.2	26.6	1.4
200	5	9.7	0.3	8.0	0.1	1.5	0.0	19.2	0.2
	10	26.7	1.9	2.7	1.4	0.7	0.1	30.2	3.2

	15	21.8	3.8	2.9	1.3	0.7	0.1	25.4	2.8
	30	22.5	0.3	2.7	1.4	1.8	1.5	27.0	0.4
	60	1.5	0.8	0.4	0.0	0.4	0.0	2.2	0.8

Data are mean value ± S.D. of three replicates

Table D6 pH and % solid loss of Microwave/NaOH pretreated Giant reed with using 0.5 % (w/v) H_2SO_4 and 15:1 LSR at different temperatures for various times.

Pretreatment		pH		% Solid loss	
Temperature (°C)	Time (min)	Value	S.D.	Value	S.D.
80	5	1.6	0.0	8.3	1.4
	10	1.7	0.1	9.7	1.1
	15	1.6	0.0	9.3	1.5
	30	1.5	0.0	8.4	0.3
	60	1.5	0.0	7.1	0.8
100	5	1.8	0.0	15.3	0.3
	10	1.7	0.0	14.7	1.8
	15	1.6	0.0	15.9	1.1
	30	1.6	0.0	23.3	3.2
	60	1.6	0.0	25.2	0.2
140	5	1.6	0.0	16.3	1.1
	10	1.6	0.0	16.8	0.3
	15	1.5	0.0	23.8	2.1
	30	1.5	0.0	29.5	2.4
	60	1.6	0.0	27.9	3.3
160	5	1.6	0.0	29.1	1.7
	10	1.6	0.0	25.1	3.5
	15	1.6	0.0	23.0	5.4
	30	1.6	0.0	27.0	2.2
	60	1.6	0.0	28.5	1.0
180	5	1.8	0.0	34.6	1.0
	10	1.7	0.0	29.8	1.1
	15	1.5	0.0	40.6	1.8

	30	1.5	0.0	51.8	2.7
	60	1.4	0.0	44.1	3.9
200	5	1.7	0.0	55.3	4.5
	10	1.7	0.0	67.5	10.3
	15	1.7	0.1	67.6	14.4
	30	1.5	0.0	65.0	14.6
	60	1.7	0.0	72.5	1.1

Data are mean value ± S.D. of three replicates

Table D7 Monomeric sugar yields of microwave/NaOH pretreated Giant reed at 180 °C for 30 min using 15:1 LSR under different H_2SO_4 concentrations.

H_2SO_4 concentration (% w/v)	Monomeric sugar yields (g/100 g biomass)							
	Glucose		Xylose		Arabinose		Total	
	Value	S.D.	Value	S.D.	Value	S.D.	Value	S.D.
0.5	26.4	2.5	4.3	0.7	1.2	0.1	31.9	1.7
1	23.0	4.4	2.1	0.4	1.1	0.8	26.2	4.0
2	22.8	5.9	1.7	0.5	1.1	0.9	25.5	6.9
3	13.4	6.0	1.1	0.2	0.6	0.0	15.1	6.1

Data are mean value ± S.D. of three replicates

Table D8 pH and % solid loss of Microwave/NaOH pretreated Giant reed at 180 °C for 30 min using 15:1 LSR under different H_2SO_4 concentrations.

H_2SO_4 concentration (% w/v)	pH		% Solid loss	
	Value	S.D.	Value	S.D.
0.5	1.8	0.0	51.8	2.7
1	1.1	0.1	73.3	5.6
2	1.1	0.1	69.9	8.4
3	1.0	0.0	76.7	1.8

Data are mean value ± S.D. of three replicates

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2. Tatijarern, P.; Prasertwasu, S.; Komolwanich., T.; Luengnaruemitchai, A.; Chaisuwan, T.; Wongkasemjit, S.; (2013, April 23) The potential of Thai grasses (Mission grass, Kans grass, and Giant reed) as a biofuel feedstock by two stage microwave/chemical pretreatment process.Proceedings of 19th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.

Presentations:

1. Tatijarern, P.; Prasertwasu, S.; Komolwanich., T.; Luengnaruemitchai, A.; Chaisuwan, T.; Wongkasemjit, S.; (2012, November 29-30) Evaluation of monomeric sugar yield from various grasses grown in Thailand as biofuel feedstocks by two stage microwave/chemical pretreatment process. Oral presented at the 24th Annual Meeting of Thai Society for Biotechnology and International Conference (TSB 2012), Ubon Ratchathani, Thailand.

2. Tatijarern, P.; Prasertwasu, S.; Komolwanich., T.; Luengnaruemitchai, A.; Chaisuwan, T.; Wongkasemjit, S.; (2013, April 23) The potential of Thai grasses (Mission grass, Kans grass, and Giant reed) as a biofuel feedstock by two stage

microwave/chemical pretreatment process. Poster presented at 19th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.

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